

REMARKS

This Amendment is submitted in response to the non-final Office Action mailed on January 15, 2010. No fee is due in connection with this Amendment. The Director is authorized to charge any additional fees which may be required, or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal is made, please indicate the Attorney Docket No. 3712174-00037 on the account statement.

Claims 26-32 and 34-39 are pending in this application. Claims 1-25 and 33 were previously canceled without prejudice or disclaimer. In the Office Action, Claims 26-32 and 34-39 are rejected under 35 U.S.C. §112. Claims 26-32 and 34-39 are further rejected under 35 U.S.C. §103. In response, Claim 26 has been amended and Claims 34 and 39 have been canceled. The amendments do not add new matter. At least in view of the amendments and/or for the reasons set forth below, Applicants respectfully submit that the rejections should be withdrawn.

In the Office Action, Claim 39 is rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. The Patent Office asserts that the limitation “wherein the graphite material is not ground” does not appear to be supported by the Specification. See, Office Action, page 3, lines 6-7. In response, Applicants have amended Claim 39 to remove the “not ground” limitation and instead recite “wherein the graphite material is obtained by directly firing the meso-carbon micro-beads at a temperature between 2500° C and 3500° C.” This amendment does not add new matter. The amendment is supported in the Specification at, for example, page 3, paragraph 35.

Accordingly, Applicants respectfully request that the rejection of Claim 39 under 35 U.S.C. §112, first paragraph, be withdrawn.

In the Office Action, Claims 26-32 and 34-39 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Patent Office asserts that the phrase “classified by particle size adjustment” is indefinite. See, Office Action, page 3, lines 16-18. In response, Applicants have amended Claim 26 to remove the limitation “classified by particle size adjustment.” This amendment does not add new matter. The amendment is supported in the Specification at, for example, page 3, paragraph 37.

Accordingly, Applicants respectfully request that the rejection of Claim 26-32 and 34-39 under 35 U.S.C. §112, second paragraph, be withdrawn.

In the Office Action, Claims 26-32 and 34-39 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,772,934 to MacFadden ("*MacFadden*") in view of U.S. Patent No. 6,280,878 B1 to Maruyama et al. ("*Maruyama*"). In response, Applicants have amended Claim 26 and canceled Claim 34. In view of the amendments and/or for at least the reasons set forth below, Applicants respectfully submit that, even if combinable, the cited references fail to disclose or suggest each and every element of independent Claim 26 and Claims 27-32 and 35-39 that depend therefrom.

Currently amended independent Claim 26 recites, in part, a gel electrolyte secondary cell comprising: a positive electrode; a negative electrode comprising a current collector and a powder mixture composed of a graphite material having a mean particle size of 5 to 100 μm ; and a gel electrolyte comprising an electrolyte salt, a non-aqueous solvent and a high-molecular weight material, wherein the non-aqueous solvent comprises propylene carbonate and ethylene carbonate, wherein a content of propylene carbonate ranges from 10 mol% to 75 mol%, and wherein the graphite material is obtained by sintering meso-carbon micro-beads. These amendments do not add new matter. The amendments are supported in the Specification at, for example, Abstract, lines 6-8; page 2, paragraphs 27-28 and 33-34; page 3, paragraph 35; page 4, paragraph 62; page 5, paragraphs 69, 78 and 82; Table 1; page 6, paragraphs 87 and 92-94; Table 2.

Propylene carbonate is desirable as a solvent in a non-aqueous electrolyte cell because it exhibits a high ion conductivity. See, Specification, page 1, paragraph 18. However, if a graphite material is used as a negative electrode in a non-aqueous liquid or gel electrolyte cell, propylene is decomposed with gas evolution due to the instability of propylene carbonate against a graphite material, thereby producing a discharge capacity loss and lowering the charging/discharging efficiency. See, Specification, page 2, paragraph 20. The degree of decomposition of propylene carbonate depends on the physical properties of the graphite material, which vary based on the starting material and the production process of the graphite material. See, Specification, page 2, paragraph 21, lines 1-7. In a non-aqueous liquid electrolyte cell using propylene carbonate in the electrolyte, it is desirable to use graphite having a large particle size because the contact area of the graphite material with the liquid electrolyte is smaller. See, Specification, page 2, paragraph 21, lines 7-15.

However, in a non-aqueous gel electrolyte cell, a graphite material having a smaller particle size is desirable in order to maintain the electron and ion conductivities between the particles of the graphite material in the anode, while also maintaining the ion conductivity at the interface between the graphite particles and the gel electrolyte. See, Specification, page 2, paragraphs 22-23. This is because if the particle size is too large, there is poor contact between the graphite particles and the gel electrolyte, and the ion conduction path is increased, thereby increasing the impedance to lower the cell voltage and deteriorating the cell performance. See, Specification, page 2, paragraph 24. The present claims therefore provide a gel electrolyte secondary cell including a negative electrode powder mixture composed of a graphite material having a mean particle size of 5 to 100 μm , wherein the graphite material is obtained by sintering meso-carbon micro-beads; and a gel electrolyte comprising an electrolyte salt, a non-aqueous solvent and a high-molecular weight material, wherein the non-aqueous solvent comprises propylene carbonate. By providing a gel electrolyte including the claimed graphite material obtained by sintering meso-carbon micro-beads in combination with propylene carbonate, a small particle size of 5 to 100 μm may be used without substantially decreasing the discharge capacity loss. See, Specification, page 2, paragraphs 26-28. In addition, because the propylene carbonate is contained in the gel electrolyte, a high ion conductivity may be obtained. See, Specification, page 1, paragraph 18. In contrast, the cited references are deficient with respect to the present claims.

For example, even if combinable, *MacFadden* and *Maruyama* fail to disclose or suggest a negative electrode comprising a current collector and a powder mixture composed of a graphite material having a mean particle size of 5 to 100 μm , wherein the graphite material is obtained by sintering meso-carbon micro-beads as recited, in part, by independent Claim 26. The Patent Office admits that *MacFadden* is silent regarding the mean particle size of the graphite material and instead relies on *Maruyama* for the claimed graphite material. See, Office Action, page 5, lines 3-15. However, nowhere does *Maruyama* teach or suggest that its graphite material is obtained by sintering meso-carbon micro-beads, nor does the Patent Office cite support for such claimed element. Instead, the Patent Office asserts that "Claim 34 is a product-by-process limitation that is not given patentable weight" in the absence of unexpected results. See, Office Action, page 2, lines 17-19; page 6, lines 1-2.

However, Applicants respectfully submit that the limitation “wherein the graphite material is obtained by sintering meso-carbon micro-beads” should be given patentable weight because the Specification demonstrates unexpected results when the claimed graphite material is used versus a graphite material obtained by another process. For example, Table 1 demonstrates initial charging/discharging efficiencies of 82.8% and 82.6% in a gel electrolyte cell when a graphite material obtained by sintering meso-carbon micro-beads is used as the anode material, whereas a significantly lower efficiency of only 61% is achieved in a gel electrolyte cell that is the entirely the same except for using a graphite material obtained by firing petroleum coke. See, Specification, page 4, paragraph 62; page 5, paragraphs 69, 71-72 and 77-78; Table 1. Similarly, Table 2 demonstrates initial charging/discharging efficiencies of 74.5% and 74.1% in a gel electrolyte cell when a graphite material obtained by sintering meso-carbon micro-beads is used as the anode material, whereas a significantly lower efficiency of only 56% is achieved in a gel electrolyte cell that is the entirely the same except for using a graphite material obtained by firing petroleum coke. See, Specification, page 5, paragraph 82; page 6, paragraphs 87-88 and 91-93; Table 2.

Nowhere does *Maruyama* disclose or suggest that its graphite material is obtained by sintering meso-carbon micro-beads. Instead, *Maruyama* merely discloses that its anode active material may be graphite having a mean particle size of 1 to 30 μm . See, *Maruyama*, column 5, lines 2-13. Thus, even if combinable, the combination of *MacFadden* and *Maruyama* fails to disclose or even suggest a negative electrode comprising a current collector and a powder mixture composed of a graphite material having a mean particle size of 5 to 100 μm , wherein the graphite material is obtained by sintering meso-carbon micro-beads in accordance with the present claims.

Accordingly, Applicants respectfully request that the rejection of Claims 26-32 and 34-39 under 35 U.S.C. §103(a) to *MacFadden* and *Maruyama* be withdrawn.

In the Office Action, Claims 26-32 and 34-39 are rejected under 35 U.S.C. §103(a) as being unpatentable over *MacFadden* in view of U.S. Patent No. 5,522,127 to Ozaki et al. (“*Ozaki*”). In response, Applicants have amended Claim 26 and canceled Claim 34. In view of the amendments and/or for at least the reasons set forth below, Applicants respectfully submit that the cited references are deficient with respect to independent Claim 26 and Claims 27-32 and 35-39 that depend therefrom.

For example, one of ordinary skill in the art would have no reason to combine the mesophase carbon micro beads of *Ozaki* with the propylene carbonate solvent of *MacFadden* to arrive at the present claims because *Ozaki* teaches away from using its micro beads with propylene carbonate. References must be considered as a whole and those portions teaching against or away from each other and/or the claimed invention must be considered. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc.*, 796 F.2d 443 (Fed. Cir. 1986). “A prior art reference may be considered to teach away when a person of ordinary skill, upon reading the reference would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the Applicant.” *Monarch Knitting Machinery Corp. v. Fukuhara Industrial Trading Co., Ltd.*, 139 F.3d 1009 (Fed. Cir. 1998), quoting, *In re Gurley*, 27 F.3d 551 (Fed. Cir. 1994).

The Patent Office asserts that “[o]ne of [ordinary] skill [in the art] would have been motivated to use the graphite negative electrode of *Ozaki* as the graphite negative electrode of *MacFadden* because both materials are capable of intercalating lithium and the graphite negative electrode of *Ozaki* leads to increased cell capacity.” See, Office Action, page 8, lines 5-8. However, Applicants respectfully submit that one of ordinary skill in the art would have no reason to substitute the graphite particles of *Ozaki* for the graphite particles of *MacFadden* because *Ozaki* teaches away from using its graphite particles with a propylene carbonate solvent such as that contained in the cell of *MacFadden*. For example, *Ozaki* expressly teaches that propylene carbonate is not suitable for use with its mesophase graphite particles:

As for the organic solvent of the organic electrolyte for the non-aqueous electrolyte, propylene carbonate (PC) is not employed, because it decomposes to generate a gas [at] during charging. On the other hand, ethylene carbonate (EC) used alone is not suitable, since it has a high melting temperature and is solid at ordinary temperature, though it has no unfavorable side reaction, as of PC. However, EC may be used in a mixed solvent of EC and either ether such as 1,2 dimethoxyethane, chain carbonate such as diethyl carbonate, ethyl methyl carbonate, or aliphatic-carboxylic acid ester such as methyl propionate, which are of low melting temperature and of low viscosity.

See, *Ozaki*, column 7, lines 5-16. *Ozaki*’s teaching that propylene carbonate has unfavorable side reactions with its graphite particles would have discouraged one of ordinary skill in the art from combining meso-carbon micro-beads with propylene carbonate in accordance with the present claims.

Applicants further submit that it would not have been obvious to combine the mesophase carbon micro beads of *Ozaki* with the propylene carbonate solvent of *MacFadden* to arrive at the present claims the Specification demonstrates unexpected results when combining propylene carbonate with graphite obtained by firing meso-carbon micro beads. For example, Table 1 demonstrates initial charging/discharging efficiencies of 82.8% and 82.6% in a gel electrolyte cell containing propylene carbonate when a graphite material obtained by sintering meso-carbon micro-beads is used as the anode material, whereas a significantly lower efficiency of only 61% is achieved in the same gel electrolyte cell when the anode material is substituted with a graphite material obtained by firing petroleum coke. See, Specification, page 4, paragraph 62; page 5, paragraphs 69, 71-72 and 77-78; Table 1. Similarly, Table 2 demonstrates initial charging/discharging efficiencies of 74.5% and 74.1% in a gel electrolyte cell containing propylene carbonate when a graphite material obtained by sintering meso-carbon micro-beads is used as the anode material, whereas a significantly lower efficiency of only 56% is achieved in the same gel electrolyte cell when the anode material is substituted with a graphite material obtained by firing petroleum coke. See, Specification, page 5, paragraph 82; page 6, paragraphs 87-88 and 91-93; Table 2.

Moreover, Applicants respectfully submit that it would not have been obvious to combine the mesophase graphite particles of *Ozaki* with the propylene carbonate-containing cell of *MacFadden* to arrive at the present claims because there would be no reasonable expectation of success in using a solvent containing propylene carbonate with the graphite particles of *Ozaki*. A reasonable expectation of success is required in order to properly combine references for an obviousness rejection. See, M.P.E.P. §2134.02 (2009). As discussed previously, *Ozaki* expressly teaches that propylene carbonate generates unfavorable side reactions with its graphite particles and is therefore not suitable for use with its graphite particles. See, *Ozaki*, column 7, lines 5-16. Moreover, one of ordinary skill in the art at the time of the invention would have understood that the degree of decomposition of propylene carbonate depends on the physical properties of the graphite material, which vary based on the starting material and the production process of the graphite material. See, Specification, page 2, paragraph 21, lines 1-7. As such, one of ordinary skill in the art would have had no reasonable expectation of success in merely substituting the mesophase graphite particles of *Ozaki* for the graphite particles in the propylene carbonate-containing cell of *MacFadden* to arrive at the present claims.

Furthermore, one of ordinary skill in the art would have no reason to combine the graphite particles of *Ozaki* with the non-aqueous solid polymer electrolyte cell of *MacFadden* to arrive at the present claims because the references are directed to different problems in different fields of endeavor. The Patent Office asserts that it would have been obvious to one of ordinary skill in the art to use the graphite particles of *Ozaki* with the solid polymer electrolyte cell of *MacFadden* because both references “teach nonaqueous secondary cells having a negative electrode including graphite and a nonaqueous electrolyte comprising a lithium salt and a mixed solvent.” See, Office Action, page 8, lines 3-8. However, “[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predictable to one of ordinary skill in the art.” See, M.P.E.P. §2143.01(III) (2009).

Ozaki is entirely directed to a non-aqueous liquid electrolyte cell including a negative electrode containing mesophase graphite particles. See, *Ozaki*, Abstract; column 2, lines 55-67; column 3, lines 1-14. *Ozaki* is entirely unconcerned with the problems associated with gel electrolytes and instead teaches that its electrolyte is prepared “by dissolving LiPF_6 (1 mol/l) in a mixed solvent of ethylene carbonate, diethyl carbonate and methyl propionate in a 3:5:2 volume ratio.” See, *Ozaki*, column 4, lines 54-58. In contrast, *MacFadden* is directed to a solid polymer electrolyte cell having a lower impedance due to the intimate contact between the solid polymer electrolyte and the active electrode material when the solid polymer electrolyte is melted and impregnated into the electrodes. See, *MacFadden*, column 2, lines 66-67; column 3, lines 1-6 and 31-40. *MacFadden* is entirely unconcerned with the properties of its anode active material and instead merely teaches that either graphite or coke are suitable anode active materials. See, *MacFadden*, column 4, lines 9-15.

One of ordinary skill in the art would understand that the problems associated with non-aqueous liquid electrolyte cells are entirely distinguishable from those associated with non-aqueous gel electrolyte cells. For example, in a non-aqueous gel electrolyte cell, a graphite material having a smaller particle size is desirable to maintain a sufficient ion conductivity at the interface between the graphite particles and the gel electrolyte. See, Specification, page 2, paragraphs 22-23. If the particle size is too large, there is poor contact between the graphite particles and the gel electrolyte, thereby increasing the impedance of the cell. See, Specification, page 2, paragraph 24, lines 1-7. However, this is not a problem in non-aqueous liquid electrolyte cells, where the liquid electrolyte can easily penetrate a space between the particles, thus scarcely

producing an increased impedance despite a large size of the graphite particles. See, Specification, page 2, paragraph 24, lines 7-13. Therefore, in a non-aqueous liquid electrolyte cell using propylene carbonate in the electrolyte, it is desirable to use graphite having a large particle size because the contact area of the graphite material with the liquid electrolyte is smaller. See, Specification, page 2, paragraph 21, lines 7-15. As such, one of ordinary skill would have had no reason to substitute the graphite particles in the non-aqueous liquid electrolyte cell of *Ozaki* for the graphite particles in the non-aqueous gel electrolyte cell of *MacFadden* to arrive at the present claims with a reasonable expectation of success because the references are directed to different problems in different fields of endeavor.

Accordingly, Applicants respectfully request that the rejection of Claims 26-32 and 34-39 under 35 U.S.C. §103(a) to *MacFadden* and *Ozaki* be withdrawn.

In the Office Action, Claims 26-32 and 34-39 are rejected under 35 U.S.C. §103(a) as being unpatentable over European Patent No. 0724305 B1 to Akashi ("*Akashi*") in view of *Ozaki*. In response, Applicants have amended Claim 26 and canceled Claim 34. In view of the amendments and/or for at least the reasons set forth below, Applicants respectfully submit that the cited references are deficient with respect to independent Claim 26 and Claims 27-32 and 35-39 that depend therefrom.

For reasons discussed previously, one of ordinary skill in the art would have no reason to combine the cited references to arrive at the present claims because *Ozaki* teaches away from using its mesophase carbon particles with propylene carbonate. Similarly, it would not have been obvious to combine the mesophase carbon micro beads of *Ozaki* with the propylene carbonate solvent of *Akashi* to arrive at the present claims the Specification demonstrates unexpected results when combining propylene carbonate with graphite obtained by firing meso-carbon micro beads. In addition, Applicants respectfully submit that it would not have been obvious to combine the mesophase graphite particles of *Ozaki* with the propylene carbonate-containing cell of *Akashi* to arrive at the present claims because there would be no reasonable expectation of success in using a solvent containing propylene carbonate with the graphite particles of *Ozaki*.


Accordingly, Applicants respectfully request that the rejection of Claims 26-32 and 34-39 under 35 U.S.C. §103(a) to *Akashi* and *Ozaki* be withdrawn.

For the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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Date: April 15, 2010